REMARKS

Claims 1, 5-17 and 19-22 are all the claims pending in the application. Claims 1 and 19 have been amended by this Amendment.

Claim 1 has been amended for clarity and to address a claim objection and rejections under 35 U.S.C. § 112, second paragraph, as discussed below. Claim 1 has been further amended to recite that the at least one gallium nitride compound semiconductor well layer is a discontinuous layer including a portion having a thickness of 0 nm. Support is found, for example, at page 13, last paragraph of the specification, which describes that the well layer is not necessarily a continuous layer, and an area where no well layer is present (i.e., a well layer portion having a thickness of 0 nm) may be included.

Claim 19 has been amended to conform to amended claim 1.

No new matter has been added. Entry of the Amendment is respectfully requested.

I. Claim Objections

(1) The Examiner objected to claims 1, 5-17 and 19-22 because the recitations of (1) "the multiple quantum well structure", and (2) "the well layer" of claim 1 lack proper antecedent basis.

In response, claim 1 has been amended for further clarity and to introduce proper antecedent basis for "the multiple quantum well structure" and "the well layer".

(2) The Examiner objected to the language "absent a well layer" of claim 1 as being unclear.

Without acquiescing in the merits of the above rejection, claim 1 has been further amended to recite that the at least one gallium nitride compound semiconductor well layer is a discontinuous layer including a portion having a thickness of 0 nm.

Withdrawal of the forgoing claim objections is respectfully requested.

II. Claim Rejection under 35 U.S.C. § 112, Second Paragraph

Claims 1, 5-17 and 19 - 22 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite.

In particular, the Examiner contended that the limitation of "the individual well layers" of the quantum well structure of claim 1 lacks sufficient antecedent basis.

In response, claim 1 has been amended for clarity and to recite that the individual gallium nitride compound semiconductor well layers of the multiple quantum well structure each has the same composition.

It is respectfully submitted that claim 1 as amended fully complies with 35 U.S.C. §112, and withdrawal of the forgoing claim rejection is respectfully requested.

III. Claim Rejections under 35 U.S.C. § 103

Claims 1, 5, 9-11, 16, 17 and 19 were rejected under 35 U.S.C. § 103(a) as allegedly being anticipated by Yamada (US 6,608,330 B1) in view of Sasaoka (US 2003/0042496 A1).

Claims 6-8 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Yamada in view of Sasaoka and Hanaoka et al. (US 5,804,839).

Claims 12, 13 and 15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Yamada in view of Sasaoka and Morita et al. (US 6,121,636).

Claim 14 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Yamada in view of Sasaoka and in further view of Kaneyama et al. (US 6,452,214 B2).

The above rejections should be withdrawn because Yamada, either alone or in view of Sasaoka, Hanaoka and/or Morita, does not render obvious the presently claimed subject matter for the following reasons.

recitation of "the same composition"

Claim 1 recites that the individual gallium nitride compound semiconductor well layers of the multiple quantum well structure each has the same composition, which limitation is not met by Yamada.

Yamada was cited by the Examiner as disclosing in Figure 1 several layers that form the gallium nitride compound semiconductor well layer 108. The Examiner considered that since all of the (first well) layers are designated with the same number "108" in Figure 1, all of the (first well) layers have the same composition. With regard to the second well layer 109 of Yamada, and in response to Applicants' position that Yamada discloses that well layers 108 and 109 have a different composition, the Examiner asserted that the well layer of Yamada can be interpreted to only comprise well layers 108, and not well layer 109. *See* pages 18-19 of the Action.

Applicants respectfully disagree.

First, Yamada discloses, at Col. 2 lines 1-7, a light emitting device having a first well layer and a second well layer which clearly differ in In composition.

Further, Yamada describes the following four features regarding interaction between the first and second well layers in Col. 4, lines 16-35:

> [1] In general, it has been understood that where the well layer having flatter composition face with the barrier layer and better crystallinity, then its luminous efficiency is higher.
>
> [2] However, there may be a certain interactive effect between the first and second well layers adjoining over the barrier layer, in a case of an active layer having multiple quantum well structure including well layers having different luminous peak wavelengths.
>
> [3] In such case, where the degree of asperity of the second well layer emitting the longer wavelength light is greater than that of the first well layer emitting the shorter wavelength light, the shorter wavelength light from the first well layer is less absorbed in the second well layer.

> [4] Further, in such case, the degree of asperity of the second well layer can be optimized to improve the luminous efficiency of the second well layer.

Particularly, the recitations [2] to [4] of Yamada disclose that, in case of an active layer having multiple quantum well structure including well layers having different luminous peak wavelengths, the degree of asperity of the well layer is effective for decreasing the absorption of light and improving the luminous efficiency. According to Yamada, in case of a multiple quantum well structure including a plurality of well layers having different luminous peak wavelengths, the degree of effect of decreasing the absorption of light and improving the luminous efficiency is determined by the relation of the arrangement of each of the well layers and the degree of asperity of each of the well layers. Moreover, the above recitations [3] and [4] of Yamada disclose that the asperity of the second well layer is more important.

The Examiner therefore can not reasonably conclude that the well layer of Yamada can be interpreted to only comprise well layers 108 where Yamada emphasis both interaction of the first and second well layer and the importance of the second well layer in achieving Yamada's objectives.

Thus, for at least the above reasons, the Examiner assertion that the well layer of Yamada can be interpreted to only comprise well layers 108, and not 109, is incorrect.

recitations of "a discontinuous layer" & "absent well layer"

Further, claim 1, as amended, recites that the at least one gallium nitride compound semiconductor well layer is a discontinuous layer including a portion having a thickness of 0 nm.

Yamada discloses at Col. 13, lines 20 – 22 that the first and second well layers 108, 109 include dished portions D having thickness less than a half of an average thickness thereof.

However, Yamada clearly does not disclose a well layer having a portion with a thickness of 0 nm.

Sasaoka

Sasaoka was relied upon by the Examiner as teaching a gallium nitride compound semiconductor light-emitting device with barrier layer being doped with a Group IV element at an average atom density of 1 x 10^{17} cm^{-3} to 5 x 10^{18} cm^{-3} (paragraph [0109]). Sasaoka does not make up the above-noted deficiencies of Yamada.

There is no motivation for one of ordinary skill in the art to apply the barrier layer to be Si-doped with a concentration of 10^{18} cm^{-3} of Sasaoka, to the multiple quantum well structure of Yamada.

The object of Sasaoka is to realize a desired highly planer surface morphology without bringing about non-flatness of the surface of the crystallized nitride-based compound semiconductor layer caused by the undesired mass-transport (paragraph [0064]).

The only barrier layer disclosed in Sasaoka is a barrier layer having the thickness of 4 nanometers (paragraph [0109]). In view of FIG. 3, Sasaoka discloses only a flat barrier layer.

Further, the invention of Sasaoka is considered to be based on the technical idea that, where the well layer has flatter composition face with the barrier layer and has better crystallinity, then its luminous efficiency is higher, in a similar manner to conventional common techniques.

The invention of Yamada differ considerably from that of Sasaoka with respect to the composition face between the well layer and the barrier layer. Thus, one of ordinary skill in the art would not be motivated to apply the invention disclosed in Sasaoka to the multiple quantum well structure disclosed in Yamada.

Hanaoka and Morita do not make up the above-noted deficiencies of Yamada and Sasaoka.

Conclusion

In view of the foregoing remarks and the amendments to claim 1, it is respectfully submitted that Yamada, either alone or in view of Sasaoka, Hanaoka and/or Morita, does not render obvious the presently claimed gallium nitride compound semiconductor light-emitting device, as recited in present claim 1.

Applicants respectfully request reconsideration and withdrawal of the foregoing rejections under 35 U.S.C. § 103.

Reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

Yan Lan
Registration No. 50,214

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE
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